

LOCKING MECHANISM FOR SEAT TRACK ASSEMBLY**BACKGROUND OF THE INVENTION****1. Field of the Invention**

5 The present invention relates to a track assembly for a seat assembly of an automotive vehicle. More particularly, the present invention relates to a seat track assembly having a locking mechanism with a plurality of locking fingers movable between a locked position for interlocking upper and lower tracks of the seat track assembly and an unlocked position disengaged from the tracks to allow sliding movement therebetween.

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2. Description of the Related Art

Automotive vehicles include seat assemblies for supporting occupants above a floor in the vehicle. Typically, a seat assembly includes a track assembly that is operatively coupled between the seat assembly and the floor of the vehicle and allows selective forward and rearward movement of the seat assembly relative to the floor. The track assembly typically includes a lower track and an upper track slidably engaged therewith, which allows the sliding movement of the seat assembly relative to the floor. Latch or locking mechanisms are commonly known in the art for interlocking the upper and lower tracks to prevent the forward and rearward movement of the seat assembly relative to the floor.

20 One type of locking mechanism known in the art utilizes a plurality of locking pawls or pins that engage one or more slots or apertures on the lower track to interlock the upper and lower tracks. Examples of these types of locking mechanisms are disclosed in German patents DE 19735030A1, DE 29700866U1 and in United States Patents 5,596,910 and 5,564,315.

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These type of locking mechanisms do not allow “infinite” or “positive” engagement between the upper and lower tracks. That is, the upper track is not lockable relative to the lower track in any position. Rather, the upper track is adjustable relative to the lower tracks 5 in predetermined increments of adjustment, as the occupant of the seat assembly must properly position the upper track along the lower track until at least one of the pins is aligned with the aperture to engage therewith and interlock the upper and lower tracks. Further, such locking mechanisms typically allow a predetermined amount of play or chuck between the upper and lower tracks.

10 It remains desirable to provide a seat track assembly having a locking mechanism that provides a minimal increment of adjustment and at the same time minimizes chuck between the upper and lower tracks.

SUMMARY OF THE INVENTION

15 According to one aspect of the invention, a locking mechanism is provided for selectively interlocking upper and lower tracks of a seat track assembly. The locking mechanism includes a pin carrier having a body and at least one arm having an intermediate portion extending between a proximal end fixedly secured to the body and a distal end. The distal end of the arm has a wider profile than the intermediate portion to define a stop edge. 20 The distal end has a bore formed therein. A mounting plate is adapted to be fixedly secured to the upper track. The mounting plate has at least one slot having adjacent narrow and wide portions defining a stop surface due to the difference in size between the narrow and wide portions. The wide portion is adapted to receive the distal end of the arm therethrough during assembly of the pin carrier and the mounting plate. The narrow portion is adapted to slidably 25 receive the intermediate portion of the arm therethrough for selective sliding movement of

the pin carrier relative to the mounting plate. The stop surface is engagable with the stop edge of the pin carrier to prevent removal of the arm from the slot. A plurality of pins are slidably coupled to both the pin carrier and the mounting plate for movement in and out of locking engagement with the upper and lower tracks during corresponding movement of the
5 pin carrier relative to the mounting plate. Each of the pins includes a raised step defining opposite first and second abutment surfaces. The first abutment surface is engagable with the body of the pin carrier such that the plurality of pins moves with the pin carrier relative to the mounting plate.

The locking mechanism also includes a plurality of coil springs each energized
10 between the second abutment surface of at least one of the plurality of pins and the mounting plate for continuously biasing apart the pin carrier and the mounting plate.

BRIEF DESCRIPTION OF THE DRAWINGS

Advantages of the present invention will be readily appreciated as the same becomes
15 better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a perspective view of a seat track assembly according to one embodiment of the invention;

Figure 2 is a cross sectional view of the seat track assembly and a locking mechanism
20 in the seat track assembly according to one embodiment of the invention;

Figure 3 is an enlarged side view of the seat track assembly;

Figure 4 is an exploded perspective view of the seat track assembly and the locking mechanism;

Figure 5 is an exploded perspective view of the locking mechanism;

Figure 6 is a perspective view of a pin carrier in the locking mechanism according to one embodiment of the invention;

Figure 7 is a perspective view of a pin in the locking mechanism according to one embodiment of the invention;

5 Figures 8a-8f are schematic views of the sizing and spacing relationship between the pins and locking windows in the locking mechanism according to one embodiment of the invention;

Figure 9 is a cross sectional view of the seat track assembly and the locking mechanism according to an alternative embodiment of the invention; and

10 Figure 10 is a schematic view of the locking mechanism according to the alternative embodiment of Figure 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figures 1 through 7, a track assembly for a seat assembly (not shown) of 15 an automotive vehicle is generally indicated at 10. The track assembly 10 includes a lower track 12 and an upper track 14. The lower track 12 is adapted to be fixedly secured to a floor in the vehicle. The upper track 14 is adapted to be fixedly secured to a bottom of a seat cushion (not shown) of the seat assembly. The upper track 14 is slidably coupled to the lower track 12 to allow selective forward and rearward movement of the seat cushion among a 20 plurality of seating positions relative to the floor. Described in greater detail below, the track assembly 10 includes a latch or locking mechanism 80 for selectively interlocking the lower 12 and upper 14 tracks to releasably lock the seat cushion in any one of the plurality of seating positions.

Referring specifically to Figures 1 and 2, the lower track 12 has a generally U-shaped 25 cross section defined by a lower web 20 extending laterally between generally upright inner

22 and outer 24 walls. Each of the inner 22 and outer 24 walls includes hooked portions 26, 28, respectively, that are turned laterally inwardly. Each of the hooked portions 26, 28 defines an upper bearing surface 30, 32. An outer flange 36 protrudes downwardly from the hooked portion 28 of the outer wall 24 toward the lower web 20. The outer flange 36 is 5 generally parallel to and spaced apart from the outer wall 24.

The upper track 14 has a generally U-shaped cross section defined by an upper web 40 that extends laterally between generally upright first 42 and second 44 walls. Each of the first 42 and second 44 walls includes hooked ends 46, 48 that are turned laterally outwardly. The hooked end 46 of the first wall 42 includes a first distal wall 58 that extends upwardly 10 toward the hooked portion 26 of the inner wall 22 of the lower track 12. A second distal wall 60 extends upwardly from the hooked end 48 of the second wall 44 toward the hooked portion 28 of the outer wall 24, such that the outer flange 36 is disposed between the second wall 44 and the second distal wall 60. The second distal wall 60 includes an outwardly flared or bent end 61. Arcuate lower bearing surfaces 50, 52 are defined by the hooked end 46 of 15 the first wall 42 and by the bent end 61 of the second distal wall 60, respectively. Each of the lower bearing surfaces 50, 52 opposes the respective upper bearing surfaces 30, 32 to define generally cylindrical bearing spaces 54, 56 therebetween. Preferably, the lower bearing surfaces 50, 52 are angled inwardly to promote centering of the upper track 14 relative to the lower track 12:

20 A plurality of ball bearings 62 is disposed in the bearing spaces 54, 56. A plurality of roller bearings 64 is supported between the hooked ends 46, 48 of the upper track 14 and the lower web 20 of the lower track 12. The ball bearings 62 and roller bearings 64 reduce friction during sliding adjustment of the upper track 14 relative to the lower track 12. Preferably, the ball bearings 62 and roller bearings 64 are offset longitudinally to allow

elastic deflection between and prevent binding of the lower 12 and upper 14 tracks under heavy loads.

Referring to Figures 2-4, a generally rectangular cutout 68 is formed in and extends longitudinally along the first wall 42 of the upper track 14. A plurality of first apertures 70 is 5 formed in and disposed longitudinally along the second wall 44 of the upper track 14. The first apertures 70 are evenly spaced apart and aligned opposite with the cutout 68. A plurality of second apertures 72 is formed in and disposed longitudinally along the second distal wall 60 of the upper track 14. The first 70 and second 72 apertures are generally aligned. A plurality of locking windows 74 is formed in and disposed longitudinally along the outer 10 flange 36 of the lower track 12.

Referring to Figures 1-5, the locking mechanism 80 is operatively coupled between the lower 12 and upper 14 tracks for releasably interlocking the lower 12 and upper 14 tracks. More specifically, the locking mechanism 80 includes a mounting plate 82 adapted to be fixedly secured to the first wall 42 of the upper track 14. The mounting plate 82 extends 15 between first 81 and second 83 ends. A pair of slots 86 are formed in the mounting plate 82, each disposed on one of the first 81 and second 83 ends of the mounting plate 82. Each slot 86 includes adjacent wide 85 and narrow 87 portions. The narrow portion 87 of the slot 86 defines a stop surface 89. A plurality of third apertures 84 is formed between the slots 86 in the mounting plate 82. The third apertures 84 are generally aligned with the first 70 and 20 second 72 apertures when the mounting plate 82 is fixedly secured to the upper track 14.

The locking mechanism 80 further includes a plurality of pins 88 and a pin carrier 90. The pin carrier 90 includes a body 92 extending between first 94 and second 96 ends. As shown in Figure 6, a plurality of fourth apertures 93 are formed between the first 94 and second 96 ends of the body 92. The fourth apertures 93 are generally aligned with first 70,

second 72 and third 84 apertures for slidably supporting each of the plurality of pins 88 therein.

An arm 98 extends outwardly from each of the first 94 and second 96 ends of the body 92. Each arm 98 includes a proximal end 95 fixedly secured to one of the first 94 and 5 second 96 ends of the body 92, a distal end 97, and an intermediate section 99 extending therebetween. Each arm 98 includes a wide section 100 defined at each distal end 97 thereof. The wide section 100 has a wider profile than the intermediate portion 99. The wide section 100 of the arm 98 is sized to pass through the wide portion 85 of the slot 86 to allow assembly of the pin carrier 90 and the mounting plate 82. The intermediate section 99 of the 10 arm 98 is sized to slidably engage the narrow portion 87 of the slot 86 after assembly of the pin carrier 90 and the mounting plate 82. A stop edge 102 is defined in the arm 98 due to the difference in width between the wide 100 and intermediate 99 sections. The stop edge 102 engages the stop surface 89 of the mounting plate 82 to prevent removal of the arms 98 from the slots 86. A bore 104 is formed in each wide section 100. The bores 104 are coaxial and 15 define a pivot axis 106. In assembly, the arms 98 are slidably engaged within the narrow portions 87 of the slots 86 for lateral displacement of the pin carrier 90 between the first 42 and second 44 walls of the upper track 14.

As best shown in Figure 7, each of the pins 88 extends longitudinally between opposite first 110 and second 112 ends. Preferably, the first end 110 of each pin 88 is tapered 20 to facilitate movement of each pin 88 in and out of engagement with the second aperture 72. Each of the pins 88 includes a raised step 114 disposed between the first 110 and second 112 ends. Each raised step 114 defines first 116 and second 118 abutment edges. The first 116 and second 118 abutment edges face the first 110 and second 112 ends, respectively. Each first end 110 of each of the pins 88 is slidably supported in one of the fourth apertures 93 of 25 the pin carrier 90. The first abutment edges 116 are engagable with the body 92 of the pin

carrier 90 to prevent the pins 88 from sliding completely through the fourth apertures 93. Similarly, each second end 112 of each of the pins 88 is slidably engaged to one of the third apertures 84 of the mounting plate 82.

The locking mechanism 80 also includes a plurality of coil springs 120. Each of the 5 coil springs 120 is coaxially supported on one of the pins 88 and compressed between the second abutment edge 118 and the mounting plate 82. While the first abutment edges 116 of the pins 88 are engaged with the body 92 of the pin carrier 90, the coil springs 120 bias the pin carrier 90 apart from the mounting plate 82. Engagement between the stop edges 102 and the stop surfaces 89 prevents the arms 98 from exiting the slots 86 due to the force applied by 10 the coil springs 120. Thus, the coil springs 120 are continuously compressed between the mounting plate 82 and the body 92 of the pin carrier 90.

Referring back to Figures 1 through 5, the locking mechanism 80 also includes a lever actuator 130. The lever actuator 130 is pivotally coupled to the mounting plate 82 for movement about a pivot axis 132 between unlocked and locked positions. Pivot pins 134 15 extend through the bores 104 of the arms 98 and pivotally interconnect the lever actuator 130 to the mounting plate 82, so that the pin carrier 90 moves laterally between the first 42 and second 44 walls in response to the pivotal movement of the lever actuator 130 between the locked and unlocked positions, respectively. Specifically, in the locked position, the stop edges 102 of the arms 98 are held against the stop edges 89 of the mounting plate 82 by the 20 compression of the coil springs 120. Movement of the lever actuator 130 about the lever pivot axis 132 toward the unlocked position causes the pin carrier 90 to move toward the mounting plate 82. The pins 88 move with the pin carrier 90. The arms 98 slide within the narrow portions 87 of the slots 86 and the second ends 112 of the pins 88 slide within the third apertures 84 to accommodate the movement of the pin carrier 90 relative the mounting

plate 82. The pins 88 move toward the mounting plate 82 with the pin carrier 90 as the body 92 of the pin carrier 90 engages the first abutment edges 116 of the pins 88.

As shown in Figure 1, the lever actuator 130 includes a cam flange 136. A "towel bar" or handle 138 is pivotally coupled to the upper track 14 by pivot pin 139. The handle 5 138 engages the cam flange 136 during manual actuation of the handle 138 to facilitate movement of the lever actuator 130 between the locked and unlocked positions.

As shown in Figure 4, the locking mechanism 80 can be pre-assembled prior to installation to the lower 12 and upper 14 tracks. After the locking mechanism 80 has been assembled, the mounting plate 82 is fixedly secured to the upper track 14 so that the pins 88 10 are aligned with the cutout 68 in the first wall 42. The second ends 112 of the pins 88 can pass through the cutout 68 to accommodate the movement of the pin carrier 90 relative to the mounting plate 82. All of the pins 88 are slidably supported by the first apertures 70 of the upper track 14 as the pins 88 are moved in and out of the locking windows 74 by the pivotal movement of the lever actuator 130 between the locked and unlocked positions, respectively. 15 Preferably, the pins 88 and locking windows 74 are sized and spaced so that, in the locked position, at least three out of five of the pins 88 are forced by the coil springs 120 through three adjacent locking windows 74 to prevent forward and rearward movement of the upper track 14 relative to the lower track 12. Most preferably, the pins 88 in the locked position are received through the locking windows 74 and supported by the first 70 and second 72 apertures, so that the pins 88 are in a double shearing condition under loading of the upper 20 track 14 relative to the lower track 12. More specifically, with the pins 88 extending through the locking windows 74 in the lower track 12 and extending through each of the first 70 and second 72 apertures of the upper track 14, any forces exerted upon the seat assembly and passing through the pins 88 are transferred through and supported by the outer flange 36 of 25 the lower track 12 and both the second wall 44 and second distal wall 60 of the upper track

14 to provide extra load support and secure locking between the lower 12 and upper 14 tracks.

The sizing and spacing of the pins 88 and locking windows 74 is best shown in Figures 8a through 8f. Each of the Figures 8b through 8f represent successive increments of 5 travel of the upper track 14 relative to the lower track 12, after that which is shown in Figure 8a. For example, Figure 8b represents one increment of travel and Figure 8f represents five increments of travel from that shown in Figure 8a. The distance of one increment of adjustment is I. The pins 88 are represented by circles labeled 1 through 5. Solid circles indicate pins 88 that are engaged with locking windows 74. Each of the pins 88 has a pin 10 width t. The spacing between adjacent pins 88 is S. The pitch or distance between the centers of adjacent pins 88 is P_t . The pitch or distance between leading edges of adjacent locking windows 74 is P_w . The width of land or distance between adjacent locking windows 74 is L. Each locking window 74 has a window width W. To ensure that at least three of 15 five pins 88 will engage the locking windows 74, the sizing and spacing of the pins 88 and locking windows 74 is established by the following equations in terms of increment I and pin width t.

$$P_t = 3I;$$

$$P_w = 5I;$$

$$W = 2I + t;$$

20 $L = 3I - t$; and

$$S = P_t - t.$$

In the preferred embodiment, the increment of adjustment I is 2.5 mm; the width t of each pin 88 is 3.5 mm; the pitch P_t of the pins 88 is 7.5 mm; the pitch P_w of the locking windows 74 is 12.5 mm; the width of the land L between adjacent locking windows 74 is 4.0 25 mm; and the width W of each locking window 74 is 8.5 mm.

In operation, the upper track 14 can be adjusted relative to the lower track 12 by unlocking the locking mechanism 80. The lever actuator 130 is rotated about the pivot axis 132 to the unlocked position by manual actuation of the handle 138. The pin carrier 90 is pulled laterally toward the mounting plate 82 against the force of the coil springs 120 as the 5 lever actuator 130 rotates toward the unlocked position. The body 92 of the pin carrier 90 engages the first abutment edges 116 of the pins 88 so that the pins 88 are displaced with the pin carrier 90 toward the mounting plate 82. When the second ends 112 of the pins 88 have exited the locking windows 74, the upper track 14 is forwardly or rearwardly slidable relative to the lower track 12. The lever actuator 130 must be manually maintained in the unlocked 10 position while the upper track 14 is adjusted relative to the lower track 12.

After the upper track 14 has been adjusted to a desired position, the handle 138 is released to allow the lever actuator 130 to return to the locked position. The coil springs 120, compressed between the mounting plate 82 and the second abutment edges 118, force the pins 88 and the pin carrier 90 away from the mounting plate 82. The stop edge 102 of the pin 15 carrier 90 engages the stop surface 89 of the mounting plate 82 to prevent further lateral movement of the pin carrier 90. The pins 88 are continuously forced toward engagement with the locking windows 74 and the second support apertures 72. As described above, at least three pins 88 engage the locking windows 74 and the second support apertures 72 to lock the upper track 14 in the desired position relative to the lower track 12.

20 Referring to Figures 9 and 10, an alternative embodiment of the invention is shown, wherein elements of the alternative embodiment similar to those in the first embodiment are indicated by primed reference characters. The pins 88' are slidably supported in the first 70', second 72', third 84' and fourth 93' support apertures for movement in and out of locking engagement with the locking windows 74'. The first ends 112' of the pins 88' are tapered to 25 facilitate movement of the pins 88 in and out of the locking windows 74' and the second

apertures 72'. The second apertures 72' are offset in a longitudinal sense relative to the first apertures 70'. The offset of the second apertures 72' relative to the first apertures 70' causes the pins 88 in the locked position to rotate and interfere or jam against the outer flange 36 of the lower track 12. Further, second apertures 72' on opposite sides of a reference plane Z, indicated by a dashed line, are offset in opposite directions with respect to the reference plane Z. As a result, at least two pins 88 in the locked position are rotated in opposite directions to minimize chuck or play of the upper track 14 relative to the lower track 12. For example, pin numbers 1 and 5 are rotated in opposite directions against the outer flange 36 at opposite ends of the respective second apertures 72' to minimize play between the lower 12 and upper 14 tracks.

It should be appreciated by those skilled in the art that while eight pins engaging five locking windows are shown in Figures 3, 5, 6 and 9, the invention requires only at least five pins for engaging three locking window. Additional pins and locking windows are utilized to enhance the strength and anti-chuck characteristics of the locking mechanism.

The invention has been described in an illustrative manner, and it is to be understood that the terminology, which has been used, is intended to be in the nature of words of description rather than of limitation. Many modification and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced other than as specifically described.